Union Electric
Callaway Plant

PO Box 620
Fulton, MO 65251

October 17, 2002

U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Mail Stop P1-137
Washington, DC 20555-0001

Ladies and Gentlemen: ULNRC-04760

DOCKET NUMBER 50-483
UNION ELECTRIC COMPANY
CALLAWAY PLANT UNIT 1
REQUEST FOR RELIEF FROM ASME SECTION III REQUIREMENTS REGARDING NON-DESTRUCTIVE EXAMINATION OF WELDS PERFORMED UNDER SITE REPAIR/REPLACEMENT PROGRAM

Pursuant to 10CFR50.55a(a)(3)(i), Union Electric Company (AmerenUE) hereby requests NRC approval of the relief described in the attachment to this letter. The requested relief involves a proposed alternative to the applicable non-destructive examination (NDE) requirements of the American Society of Mechanical Engineers (ASME) Code for a particular group of Class 2 piping welds that may be required in the forthcoming refueling outage (RF-12) at Callaway.

For the inservice inspection and testing program at Callaway, including repair/replacement activities, AmerenUE is committed to the 1989 Edition (no addenda) of Section XI of the ASME code for the current ten-year inservice inspection interval (which began on August 1, 1995). ASME Class 1, 2 and 3 welds installed under Callaway's repair/replacement program are nondestructively examined in accordance with the 1974 Edition (with Summer 1975 Addenda) of Section III of the ASME Code, i.e., the ASME Construction Code for Callaway, or alternatively, in accordance with the 1992 Edition (with no addenda) of ASME Section III when pressure testing is performed in accordance with Code Case N-416-1. For certain weld joint configurations and sizes, radiography is required in accordance with ASME Section III Subarticles NB-5200, NC-5200 and ND-5200.

During the forthcoming refueling outage at Callaway, inspections of Class 2 piping sections in the main feedwater system are planned. The inspections are a follow-up activity from the identification of pipe-wall thinning in the feedwater piping during the last refueling outage at Callaway (i.e., RF-11). The pipe wall thinning was found to be more prevalent in certain sections than others, and as a

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result, some sections were replaced, though no sections had less than minimum required pipe wall thickness. One particular section(s) of the piping that was inspected but found to be acceptable, is the 5-diameter bend that occurs in each feedwater line just before the piping enters each of the four steam generators in the containment building. These sections are to be re-inspected in RF-12 to determine if additional thinning has occurred. Inspections in the forthcoming outage may yield results that do not warrant further action at this time. However, contingency plans have been developed to replace these sections if needed and to perform the necessary NDE of the pipe welds, under Callaway's repair/replacement program.

With respect to the NDE to be performed on the feedwater system welds, and for the reasons discussed in the attachment to this letter, AmerenUE prefers to perform ultrasonic examination of the welds in lieu of the radiography required by subarticle NC-5200 of ASME Section III. A detailed description of the ultrasonic examination method to be employed is included in the attachment to this letter. AmerenUE has determined that the proposed ultrasonic examination method (in lieu of radiography) provides an acceptable level of quality and safety. Accordingly, AmerenUE requests Code relief pursuant to 10 CFR 50.55a(a)(3)(i) to permit implementation of the proposed alternative to the radiography requirements of Section III Subarticle NC-5200 for the applicable Class 2 piping welds.

Please note that RF-12 is scheduled to commence October 23, 2002. According to the outage schedule, replacement of the noted feedwater piping sections (if needed) could be completed by October 28. Since NDE of the associated welds would be needed shortly after completion of the piping replacements, AmerenUE respectfully requests approval of the requested relief by October 31, 2002.

For any questions you may have or more information that you may require, please contact David Shafer at 314-554-3104, or Thomas Elwood at 314-554-4593.

Very truly yours,

John D. Blosser
Manager-Regulatory Affairs

TBE/jdg
Attachment

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Manager, Electric Department
Missouri Public Service Commission
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Jefferson City, MO 65102

Request to Use Alternative Ultrasonic Examination Method in Lieu of the Radiography Required by ASME Section III, Subarticle NC-5200

Background:

The 1989 Edition with no Addenda of ASME Section XI currently governs repair/replacement activities at the Callaway Nuclear Plant. Callaway Plant is currently in the second 10-year inservice inspection interval which began on August 1, 1995. ASME Class 2 welds installed under the Callaway Repair/Replacement Program are nondestructively examined in accordance with the 1974 Edition with Summer 1975 Addenda of ASME Section III. Alternatively, when pressure testing is performed in accordance with Code Case N-416-1, the welds are nondestructively examined in accordance with the 1992 Edition with no Addenda of ASME Section III. Pursuant to the provisions of 10CFR 50.55a(a)(3)(i), Callaway Plant requests permission to use an alternative ultrasonic examination method in accordance with the justification, requirements, and provisions detailed below in lieu of the radiography required by ASME Section III, NC-5200.

Components for Which Alternative Ultrasonic Examination is Requested:

Alternative ultrasonic examination is requested for Class 2 feedwater pipe welds listed in Table 1. This table lists the pipe description, weld identification number, nominal pipe size, pipe schedule, and pipe base material for each weld.

Justification for Alternative Ultrasonic Examination in Lieu of Radiography:

The proposed alternative ultrasonic examination will ensure an adequate level of safety and quality and will provide adequate verification that the Class 2 welds are free of significant flaws that could affect structural integrity. The examination will cover 100% of the weld volume and include base material for a distance of 1/2 the nominal through-wall weld thickness on each side of the weld. A demonstration of the ultrasonic examination system capability to detect both subsurface and surface workmanship type flaws (i.e., slag, porosity, lack of fusion, and incomplete penetration) will be performed on a qualification block. All flaws and indications will be evaluated in accordance with the standard acceptance criteria of NC-5330. In addition, an automated scan and data acquisition system will be used to improve examination repeatability and provide permanent storage of the raw data. Finally, the proposed alternative ultrasonic examination will be limited to base material and weld material that is conducive to ultrasonic examination.

Ultrasonic and radiographic examination methods are complimentary and are not directly comparable or equivalent. Depending on flaw type (i.e., volumetric or planar) and orientation, ultrasonic examination may be superior to radiography or vice versa. Radiography is most effective in detection of volumetric type flaws (i.e., slag and porosity) and detection of planar type flaws (i.e., lack of fusion and cracks) that are

oriented in a plane parallel to the x-ray beam. However, radiography is limited in detection of planar flaws not oriented parallel to the beam. In contrast, ultrasonic examination is very effective in detection of planar type flaws that are not oriented in a plane parallel to the sound beam and less effective in detecting flaws in a plane parallel to the sound beam. Finally, ultrasonic examination is capable of detecting volumetric type flaws such as slag or porosity but is limited, compared to radiography, in ability to characterize volumetric flaws.

The proposed alternative ultrasonic examination requirements and provisions address the known limitations of the ultrasonic method to ensure both planar and volumetric flaws in all orientations are detected and properly evaluated. First, examination using two angle beams (i.e., 45 and 60 degree nominally) or a procedure qualified on 100% of the weld volume in accordance with the performance demonstration methodology of Section XI, Appendix VIII is required. Second, scans in two directions perpendicular to the weld axis and two directions parallel to the weld axis are required. Third, to ensure laminar type flaws are detected, a supplemental examination using straight beam is also required. Finally, if an indication, such as slag or porosity, is not characterized as volumetric, the indication will be characterized as a planar type flaw and evaluated in accordance with the acceptance criteria of NC-5330. The acceptance criteria of NC-5330 specifies acceptable length of an indication only and does not differentiate between planar and volumetric type flaws. Most importantly, planar type flaws such as cracks, incomplete penetration, and lack of fusion, which are rejectable by NC-5330 for any size, are more readily and properly characterized by ultrasonic examination.

In addition to the effectiveness of the proposed alternative, use of ultrasonic examination in lieu of radiography will provide a significant reduction in personnel radiation exposure during refueling outage maintenance work. Also, outage duration and costs will be reduced by allowing parallel path work to progress uninterrupted during examination of welds. Finally, the personnel safety risk of inadvertent or accidental exposure and also the normal anticipated exposure associated with transportation, positioning and exposing a source for radiography is eliminated.

Proposed Alternative Ultrasonic Examination Requirements and Provisions:

For ASME Class 2 welds installed under the Callaway Repair/Replacement Program where ultrasonic examination will be performed in lieu of radiography the following requirements shall apply:

(1) The nominal weld thickness shall be 1/2 inch or greater.

(2) The ultrasonic examination shall not be applied to welds that include austenitic cast product forms or austenitic corrosion-resistant-clad piping butt welds.

(3) The ultrasonic examination area shall include 100% of the volume of the entire weld plus 0.5T on each side of the weld, where T is the nominal

thickness of the weld. The ultrasonic examination area shall be accessible for angle beam examination in four directions, two directions perpendicular to the weld axis and two directions parallel to the weld axis. Where perpendicular scanning is limited on one side of the weld, a technique using the second leg of the V-path may be credited as access for the second perpendicular examination direction provided that the detection capability of that technique is included in the procedure demonstration described in (5) and (6) below.

(4) The ultrasonic examination shall be in accordance with (a) or (b) below:

(a) Examination shall be performed in accordance with Section V, Article 5 up to and including the 2001 Addenda. Two angle beams having nominal angles of 45 and 60 degrees should generally be used; however, other pairs of angle beams may be used provided the measured difference between the angles is at least 10 degrees. A supplemental straight beam shall also be used.

(b) Examination shall be performed by a procedure qualified in accordance with the performance demonstration methodology of Section XI, Appendix VIII provided the entire volume of the weld examination is included in the demonstration. A supplemental straight beam shall also be used.

(5) A written procedure shall be followed. The procedure shall be demonstrated to perform acceptably on a qualification block or specimen that includes a weld with both surface and subsurface flaws as described in (7) below.

(6) The qualification block material shall conform to the requirements applicable to the calibration block and in addition meet the following requirements:

(a) The material from which blocks are fabricated shall be one of the following: a nozzle dropout from the component; a component prolongation; or material of the same material specification, product form, and heat treatment condition as one of the materials joined. For piping, if material of the same product form and specification is not available, material of similar chemical analysis[1], tensile properties, and metallurgical structure[2] may be used.

(b) Where two or more base material thicknesses are involved, the calibration block thickness shall be of a size sufficient to contain the entire examination path.

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[1] *Chemical composition is within the same ranges as required in the original material specification.*

[2] *Same phase and grain shape as produced by the thermal process for the original specification.*

(c) Qualification block configuration shall contain a weld representative of the joint to be ultrasonically examined, including, for austenitic materials, the same welding process.

(7) The qualification block shall include flaws in accordance with (a) or (b) below:

(a) At least two planar flaws shall be included in the qualification block weld, one surface and one subsurface oriented parallel to the fusion line. The flaws shall be no larger in the through-wall direction than the diameter of the applicable side-drilled hole in the calibration block shown in Figure T-542.2.1 of Section V, Article 5, and no longer than the shortest unacceptable elongated discontinuity length listed in NC-5330 for the thickness of the weld that will be examined.

(b) Where a Section XI, Appendix VIII, performance demonstration methodology is used, supplemental qualification to a previously approved procedure may be demonstrated through the use of a blind test with appropriate specimens that contain a minimum of three different construction-type and fabrication-type flaws distributed throughout the thickness of the specimen(s).

(8) A documented examination plan shall be provided showing the transducer placement, movement and component coverage that provides a standardized and repeatable methodology for weld acceptance. The examination plan shall also include the ultrasonic beam angle used, beam directions with respect to weld centerline, and volume examined for each weld.

(9) The ultrasonic examination shall be performed using a device with an automated computer data acquisition system.

(10) Data shall be recorded in unprocessed form. A complete data set with no gating, filtering, or thresholding for response from the examination volume in paragraph (3) above shall be included in the data record.

(11) Personnel who acquire and analyze ultrasonic data shall be qualified and trained using the same type of equipment as in (9) above, and demonstrate their capability to detect and characterize the flaws using the procedure as described in (5) above.

(12) The evaluation and acceptance criteria shall be in accordance with Section III NC-5330.

(13) Flaws exceeding the applicable acceptance criteria referenced in (12) above shall be repaired, and the weld subsequently reexamined using the same ultrasonic examination procedure that detected the flaw.

(14) Review and acceptance of the ultrasonic examination procedure by the Authorized Nuclear Inservice Inspector is required.

(15) All other related requirements of the Callaway Repair/Replacement Program shall be met.

(16) Use of ultrasonic examination in lieu of radiography shall be documented in accordance with the Callaway Repair/Replacement Program on a Form NIS-2A and/or Section XI Repair/Replacement Plan, as applicable.

Table 1: Feedwater Pipe Welds

Description	Weld ID No.	NPS	Sch.	Mat.
5-Dia. bend & expander upstream of A S/G inlet	2-AE-04-F014	14	80	CS
	2-AE-04-S010-A	14	80	CS
	2-AE-04-S010-C	16	80	CS
5-Dia. bend upstream of B S/G inlet	2-AE-04-F030	14	80	CS
	2-AE-04-FW8	14	80	CS
5-Dia. bend & expander upstream of C S/G inlet	2-AE-05-F030	14	80	CS
	2-AE-05- S021-A	14	80	CS
	2-AE-05-S021-C	16	80	CS
5-Dia. bend & expander upstream of D S/G inlet	2-AE-05-F015	14	80	CS
	2-AE-05-S022-A	14	80	CS
	2-AE-05-S022-C	16	80	CS
Elbow & pipe upstream of valve AEV0120 (B loop)	2-AE-04-S017-A	14	80	CS
	2-AE-04-F027	14	80	CS
	2-AE-04-F067	14	80	CS
Elbow & pipe downstream of valve AEV0120 (B loop)	2-AE-04-F070	14	80	CS
	2-AE-04-S019-A	14	80	CS
	2-AE-04-FW10	14	80	CS
Elbow downstream of valve AEV0123 (C loop)	2-AE-05-F029	14	80	CS
	2-AE-05-S020-A	14	80	CS
Elbow & pipe upstream of valve AEV0122 (D loop)	2-AE-05-F012	14	80	CS
	2-AE-05-S008-A	14	80	CS
	2-AE-05-F073	14	80	CS

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Manager, Electric Department
Missouri Public Service Commission
PO Box 360
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Background:

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For ASME Class 2 welds installed under the Callaway Repair/Replacement Program where ultrasonic examination will be performed in lieu of radiography the following requirements shall apply:

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(2) The ultrasonic examination shall not be applied to welds that include austenitic cast product forms or austenitic corrosion-resistant-clad piping butt welds.

(3) The ultrasonic examination area shall include 100% of the volume of the entire weld plus 0.5T on each side of the weld, where T is the nominal

thickness of the weld. The ultrasonic examination area shall be accessible for angle beam examination in four directions, two directions perpendicular to the weld axis and two directions parallel to the weld axis. Where perpendicular scanning is limited on one side of the weld, a technique using the second leg of the V-path may be credited as access for the second perpendicular examination direction provided that the detection capability of that technique is included in the procedure demonstration described in (5) and (6) below.

(4) The ultrasonic examination shall be in accordance with (a) or (b) below:

(a) Examination shall be performed in accordance with Section V, Article 5 up to and including the 2001 Addenda. Two angle beams having nominal angles of 45 and 60 degrees should generally be used; however, other pairs of angle beams may be used provided the measured difference between the angles is at least 10 degrees. A supplemental straight beam shall also be used.

(b) Examination shall be performed by a procedure qualified in accordance with the performance demonstration methodology of Section XI, Appendix VIII provided the entire volume of the weld examination is included in the demonstration. A supplemental straight beam shall also be used.

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(6) The qualification block material shall conform to the requirements applicable to the calibration block and in addition meet the following requirements:

(a) The material from which blocks are fabricated shall be one of the following: a nozzle dropout from the component; a component prolongation; or material of the same material specification, product form, and heat treatment condition as one of the materials joined. For piping, if material of the same product form and specification is not available, material of similar chemical analysis[1], tensile properties, and metallurgical structure[2] may be used.

(b) Where two or more base material thicknesses are involved, the calibration block thickness shall be of a size sufficient to contain the entire examination path.

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[1] *Chemical composition is within the same ranges as required in the original material specification.*

[2] *Same phase and grain shape as produced by the thermal process for the original specification.*

(c) Qualification block configuration shall contain a weld representative of the joint to be ultrasonically examined, including, for austenitic materials, the same welding process.

(7) The qualification block shall include flaws in accordance with (a) or (b) below:

(a) At least two planar flaws shall be included in the qualification block weld, one surface and one subsurface oriented parallel to the fusion line. The flaws shall be no larger in the through-wall direction than the diameter of the applicable side-drilled hole in the calibration block shown in Figure T-542.2.1 of Section V, Article 5, and no longer than the shortest unacceptable elongated discontinuity length listed in NC-5330 for the thickness of the weld that will be examined.

(b) Where a Section XI, Appendix VIII, performance demonstration methodology is used, supplemental qualification to a previously approved procedure may be demonstrated through the use of a blind test with appropriate specimens that contain a minimum of three different construction-type and fabrication-type flaws distributed throughout the thickness of the specimen(s).

(8) A documented examination plan shall be provided showing the transducer placement, movement and component coverage that provides a standardized and repeatable methodology for weld acceptance. The examination plan shall also include the ultrasonic beam angle used, beam directions with respect to weld centerline, and volume examined for each weld.

(9) The ultrasonic examination shall be performed using a device with an automated computer data acquisition system.

(10) Data shall be recorded in unprocessed form. A complete data set with no gating, filtering, or thresholding for response from the examination volume in paragraph (3) above shall be included in the data record.

(11) Personnel who acquire and analyze ultrasonic data shall be qualified and trained using the same type of equipment as in (9) above, and demonstrate their capability to detect and characterize the flaws using the procedure as described in (5) above.

(12) The evaluation and acceptance criteria shall be in accordance with Section III NC-5330.

(13) Flaws exceeding the applicable acceptance criteria referenced in (12) above shall be repaired, and the weld subsequently reexamined using the same ultrasonic examination procedure that detected the flaw.

(14) Review and acceptance of the ultrasonic examination procedure by the Authorized Nuclear Inservice Inspector is required.

(15) All other related requirements of the Callaway Repair/Replacement Program shall be met.

(16) Use of ultrasonic examination in lieu of radiography shall be documented in accordance with the Callaway Repair/Replacement Program on a Form NIS-2A and/or Section XI Repair/Replacement Plan, as applicable.

Table 1: Feedwater Pipe Welds

Description	Weld ID No.	NPS	Sch.	Mat.
5-Dia. bend & expander upstream of A S/G inlet	2-AE-04-F014	14	80	CS
	2-AE-04-S010-A	14	80	CS
	2-AE-04-S010-C	16	80	CS
5-Dia. bend upstream of B S/G inlet	2-AE-04-F030	14	80	CS
	2-AE-04-FW8	14	80	CS
5-Dia. bend & expander upstream of C S/G inlet	2-AE-05-F030	14	80	CS
	2-AE-05- S021-A	14	80	CS
	2-AE-05-S021-C	16	80	CS
5-Dia. bend & expander upstream of D S/G inlet	2-AE-05-F015	14	80	CS
	2-AE-05-S022-A	14	80	CS
	2-AE-05-S022-C	16	80	CS
Elbow & pipe upstream of valve AEV0120 (B loop)	2-AE-04-S017-A	14	80	CS
	2-AE-04-F027	14	80	CS
	2-AE-04-F067	14	80	CS
Elbow & pipe downstream of valve AEV0120 (B loop)	2-AE-04-F070	14	80	CS
	2-AE-04-S019-A	14	80	CS
	2-AE-04-FW10	14	80	CS
Elbow downstream of valve AEV0123 (C loop)	2-AE-05-F029	14	80	CS
	2-AE-05-S020-A	14	80	CS
Elbow & pipe upstream of valve AEV0122 (D loop)	2-AE-05-F012	14	80	CS
	2-AE-05-S008-A	14	80	CS
	2-AE-05-F073	14	80	CS